Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] A method for dense encoding and retrieving of information represented in electronic computers, the method comprising

(a) choosing an appropriate modulus m, positive integer n, corresponding to the number of bits to be encoding, and generating n x n matrix A with integer elements where the diagonal elements of A differs modulo m from all the other elements of their column, and where A can be written as matrix product BC where B is an n x t matrix, C is a t x n matrix, where t is less than n;

(b) encoding the length-n vector x to the length-t vector xB, by vector-matrix product modulo m;

(c) storing the length-t vector xB in physical computational devices;

(d) retrieving the stored vector by computing xBC=xA by vector-matrix product modulo m;

(e) for every coordinate of vector xBC=xA, filtering out the terms added as the linear combination of other coordinates of vector x.

[c2] A method according to claim 1, wherein the modulus m is non-prime- power composite positive integer, the di-

agonal elements of matrix A are non-zero modulo any prime-divisors of m, and each non-diagonal elements of matrix A are zero modulo for at least one prime divisor of m.

[c3] A method according to claim 2, wherein the filtering step for retrieving the original values of the encoded 0-1 vector x further comprising:
(a) periodical change of the values of the coordinates of vector x with original value equal to 1 on values 0,1,2,...,m-1, and no change of the values of the coordinates of vector x with original value equal to 0;
(b) measuring the periodicity of each coordinates of vector xBC=xA;
(c) if a coordinate has period equal to m then its original value was 1.

[c4] A method according to claim 1, wherein vector x to be compacted is a row-vector of a matrix.

[c5] A method according to claim 1, wherein vector x to be compacted is a column-vector of a matrix.

[c6] A system for dense encoding and retrieving of information represented in electronic computers or other physical devices, the system comprising
(a) choosing a modulus m to be a non-prime-power

composite positive integer, positive integer n corresponding to the number of bits to be encoded, and generating n x n matrix A with the diagonal elements being non-zero modulo any prime-divisors of m, and each non-diagonal elements of matrix A are zero modulo for at least one prime divisor of m, and where A can be written as matrix product BC where B is an n x t matrix, C is a t x n matrix, where t is less than n;

(b) choosing step-fuctions $s_1, s_2, \ldots, s_n$ on the [a,b] real interval, corresponding to time, such that the following properties hold:

(b1) function s_i has finitely many, but at least one non-zero steps modulo m, for i=1,2,...,n;

(b2) step of function s_i is either 0 modulo m or it is non-zero modulo all individual prime-divisors of number m, for i=1,2,...,n;

(b3) no two different functions s_i and s_k have non-zero steps in the same point r in the real interval [a,b];

(c) by denoting the n bits to be stored by $h_1, h_2, \ldots, h_n$, bit h_i is encoded first as $x_i = h_i s_i$, for i =1,2,...,n;

(d) with matrix B, z=xB is computed;

(e) step functions $z_1, z_2, \ldots, z_t$ are stored;

(f) x'=zC=xBC modulo m is computed;

(g) by observing the change of the values of the piece-wise constant function x_i', we conclude that if all the steps of function x_i' are 0 modulo at least one prime di-

visor of m, then $h_i=0$, otherwise, $h_i=1$.

[c7] A system, according to claim 6, wherein step-functions are stored in physical devices admitting linear combinations, and the values of the steps modulo m can be observed from the spectrum of electromagnetic radiation emitted by the devices.

[c8] A system according to claim 6, wherein vector $h=h_1, h_2, \ldots, h_n$ to be compacted is a row-vector of a matrix.

[c9] A system according to claim 6, wherein vector $h=h_1, h_2, \ldots, h_n$ to be compacted is a column-vector of a matrix.

[c10] A method for computing the product of the n x n matrix X and the n x n matrix Y, the method comprising:

(a) the column compacting of matrix X is done by computing $B^T X$;

(b) the row compacting of matrix Y is done by computing YB;

(c) from the t x n matrix $B^T X=\{u_{ij}\}$ and from the n x t matrix $YB=\{v_{kl}\}$ the t x t matrix $W=\{w_{il}\}$ is computed as:

$w_{il}=\Sigma^t_{j=1} (\Sigma^n_{k=1} b_{kj} u_{ik}) (\Sigma^n_{k=1} c_{jk} v_{kl})$;

(d) the column expanding process is done by computing $C^T W$;

(e) the row expanding process is done by computing $C^T WC$;

(f) a filtering process is done for retrieving the values of the product matrix.